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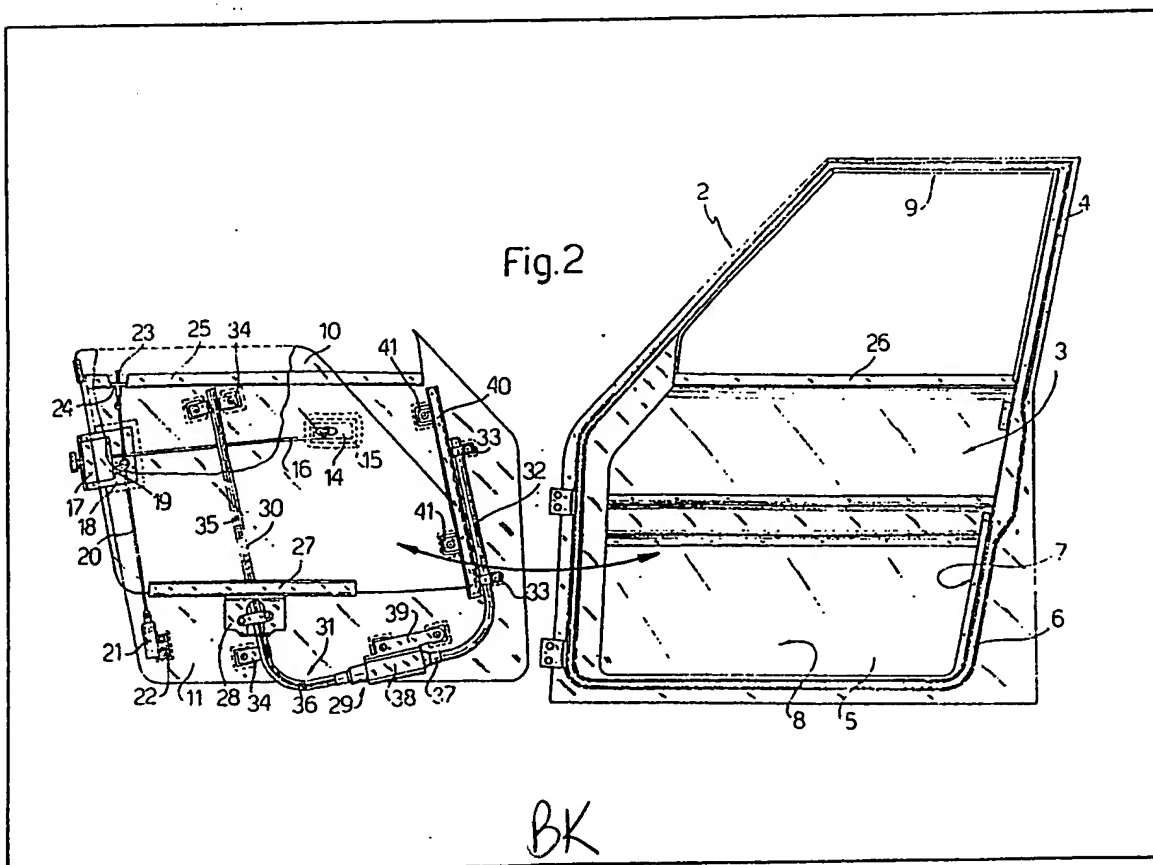
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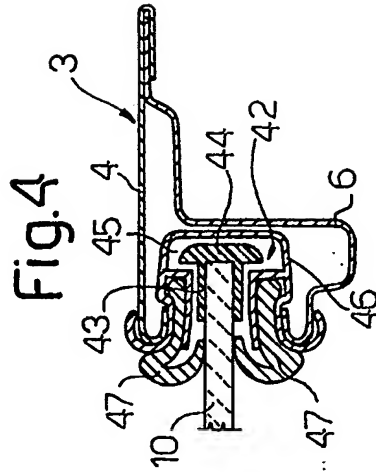
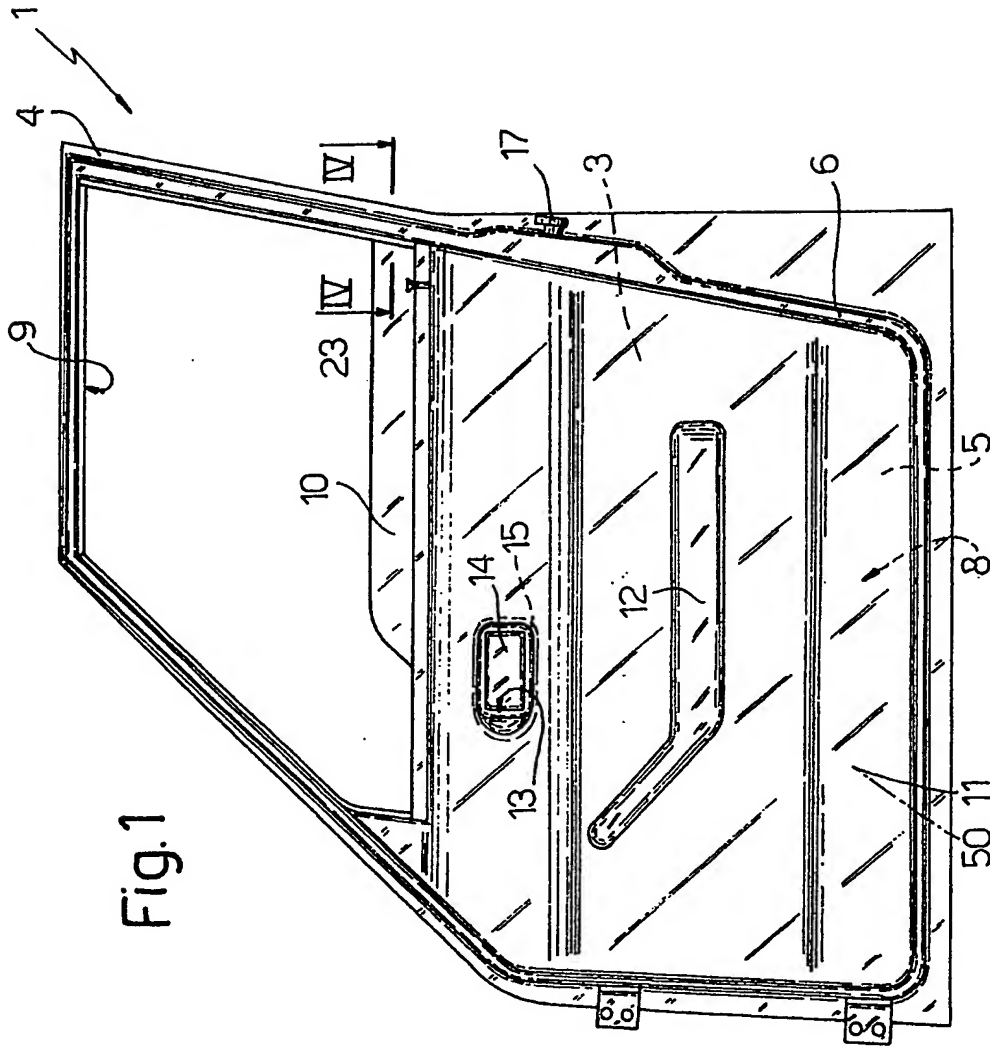
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## (54) Method of constructing a motor vehicle door

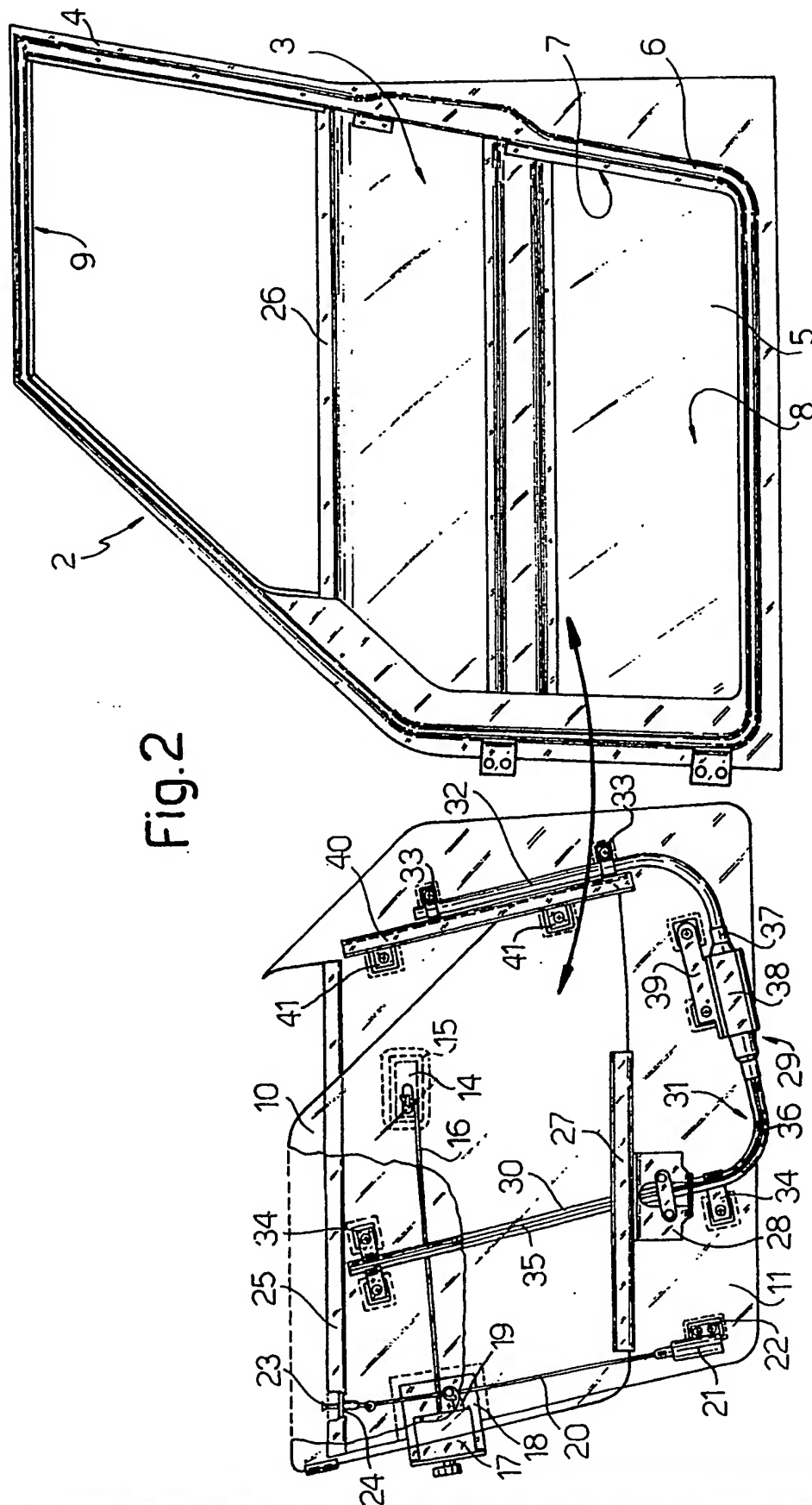
(57) The method consists of a first stage of producing an external door element provided with a frame (2) defining a window aperture (9) of the door (1); a second stage of mounting the external element on the hinges of the vehicle body and painting it together with the body; a third stage of preparing an internal supporting element (11) of the door (1) having mounted thereon at least a window regulator device (29), the window (10) and at least one guide channel (40) for the window (10); and a fourth stage of fitting the internal element (11) to the external element (2) already mounted on the body.



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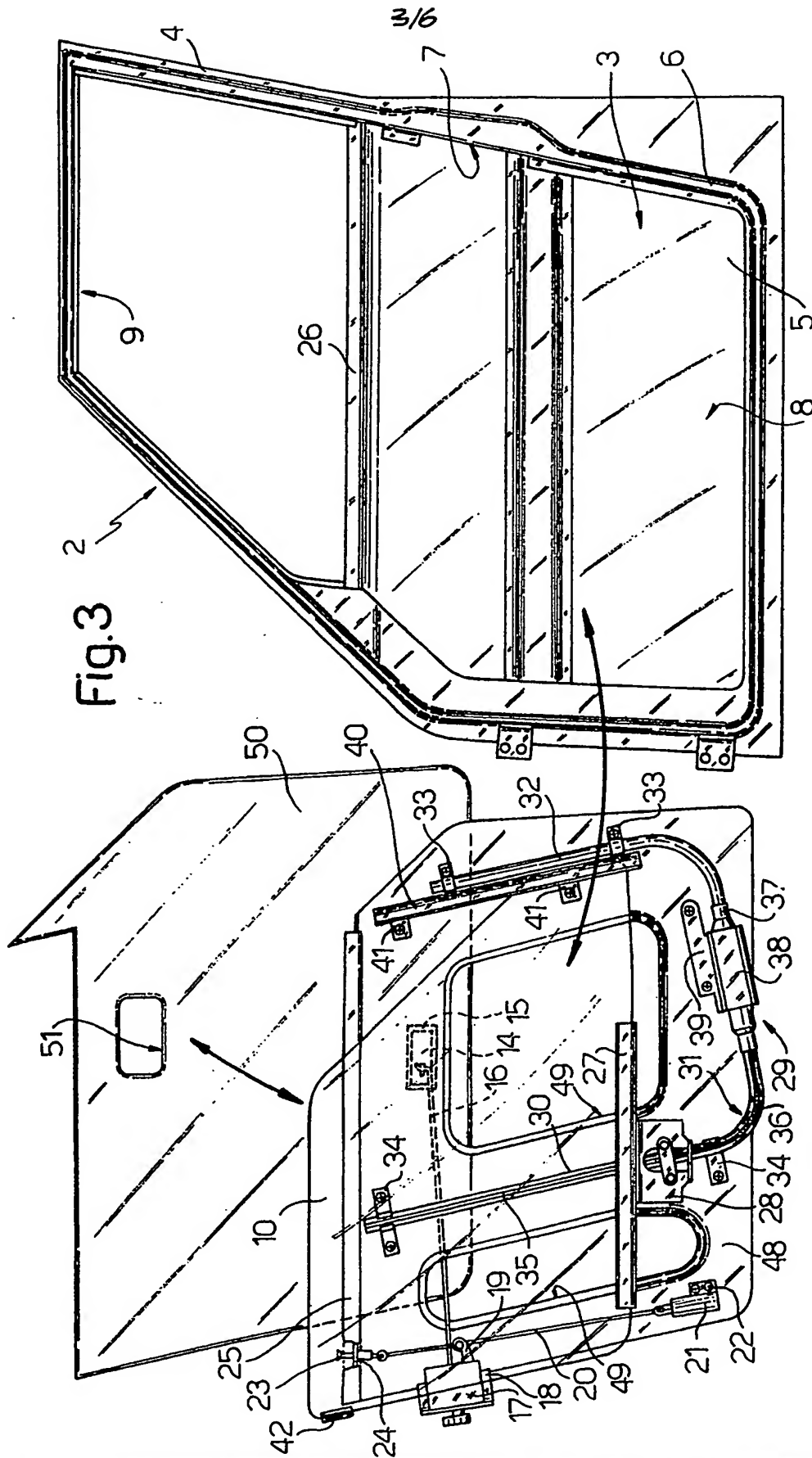
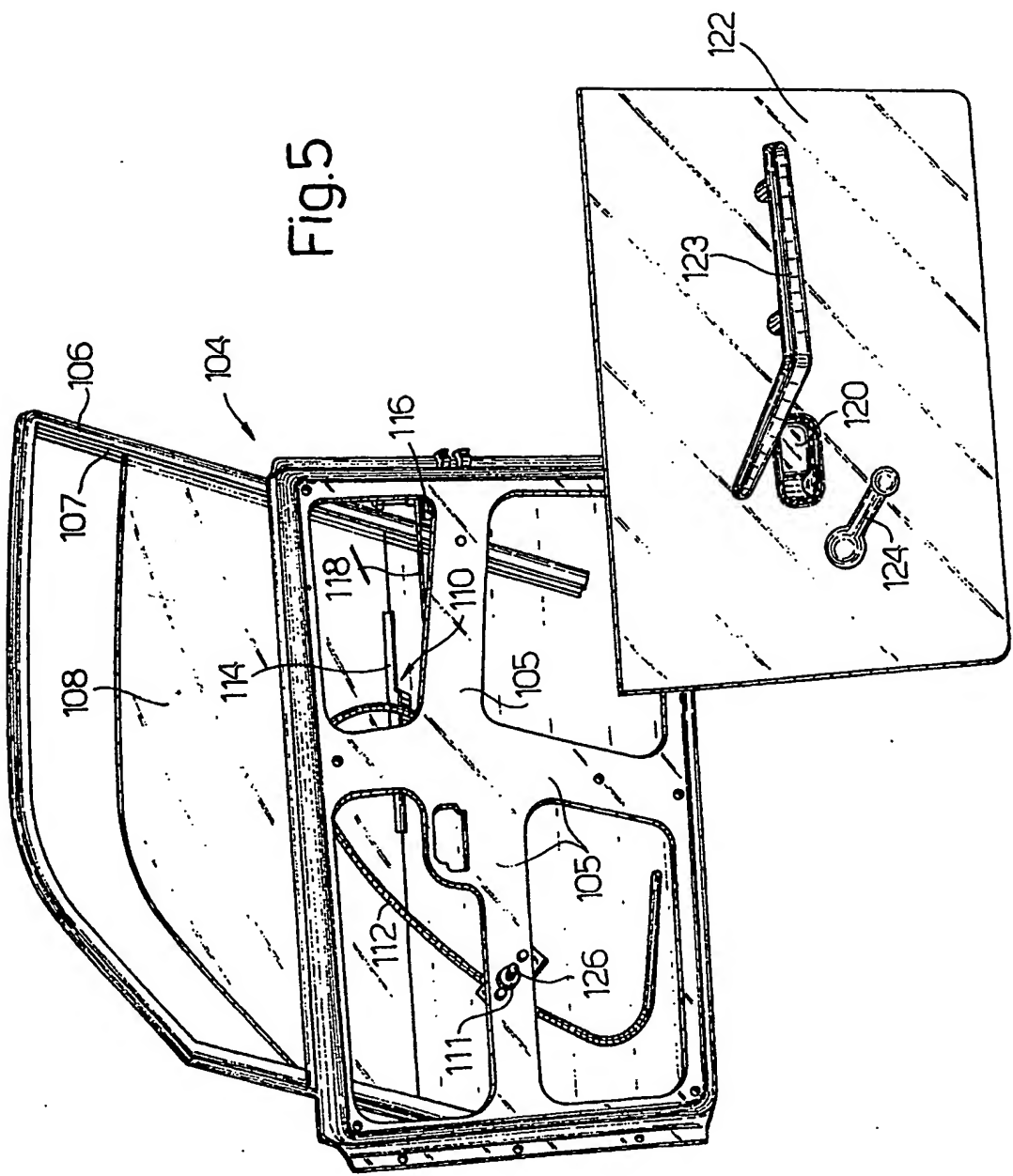
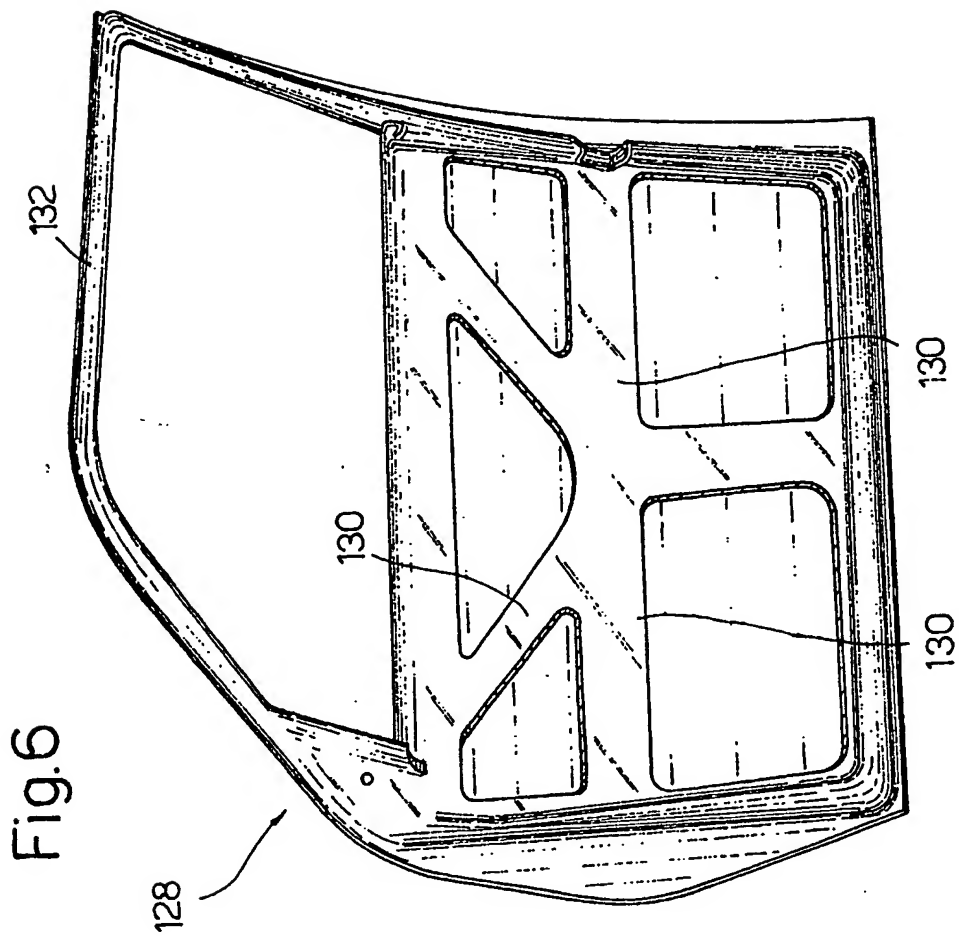
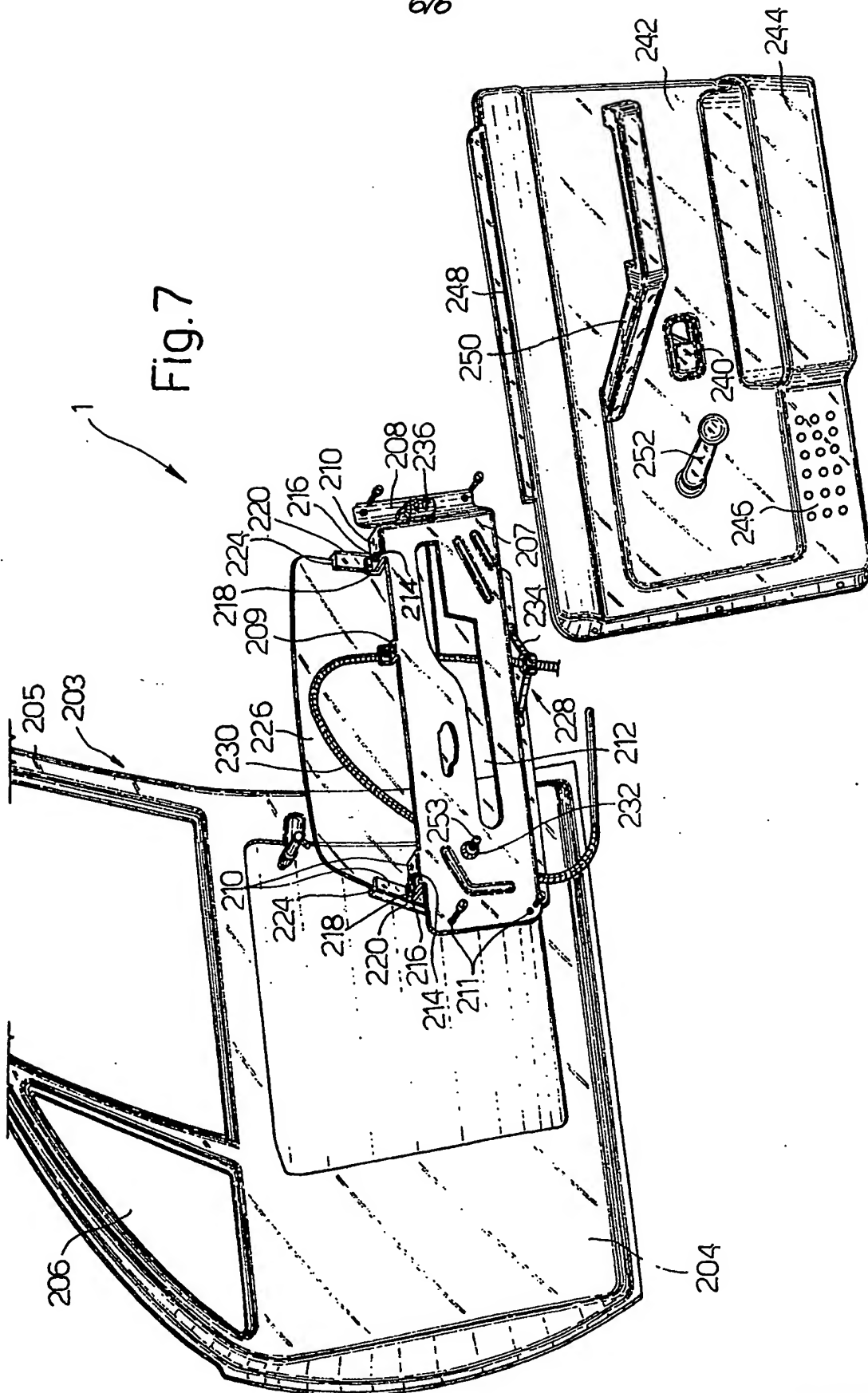


Fig.3

Fig.5







## SPECIFICATION

**Method of constructing a motor vehicle door, a door constructed by said method, and a motor vehicle having at least one such door**

- 5 The present invention relates to a method for constructing motor vehicle doors.
- At the present time, motor vehicle doors are normally constructed by rigidly joining together two metal plates defining an upper aperture
- 10 arranged to be closed by a mobile window. Of said plates, one is disposed externally and defines the outer surface of the door, and the other is disposed internally and in its lower part comprises a plurality of apertures through which access can be
- 15 gained to an inner chamber. This latter is arranged to house a plurality of devices such as the door opening and closure devices, a window regulator device supporting a connected respective mobile window, and guide means for controlling the
- 20 trajectory of movement of said window between a lowered position in which the window is contained within said chamber and a raised position in which said upper aperture is closed.
- Such devices are assembled in the door in
- 25 known manner along an assembly line by successively inserting said devices through said apertures and fixing them to the inner plate.
- Such a procedure gives rise to considerable drawbacks both of a technical and economical
- 30 nature. In this respect, the operators, in inserting said devices through the respective apertures and fixing them to the inside of said chamber, have to carry out a series of relatively difficult operations which require considerable time and thus
- 35 considerably influence the total assembly cost. In addition, doors produced by the aforesaid known method normally have to be adjusted after assembly because it is substantially impossible to properly set all relative devices during their
- 40 assembly along the assembly line.
- The object of the present invention is to provide a method for constructing motor vehicle doors which is free from the aforesaid drawbacks.
- According to the present invention a method of
- 45 constructing a vehicle door is characterised by comprising, in combination:
- a first stage of constructing an external element of said door comprising a rigid frame defining an upper aperture arranged to be closed by a mobile
- 50 window, and at least one lower cavity closed towards the outside of said vehicle by a wall formed integrally in a single piece with said frame;
- a second stage of mounting said external element on the hinges of the body of said vehicle
- 55 and painting it together with said body;
- a third stage of constructing an internal element of said door arranged to close said cavity towards the inside of said vehicle, and mounting on said internal element a plurality of devices for
- 60 said door which comprise at least a window regulator device, said mobile window fixed on to said window regulator device, and at least one guide channel arranged to cooperate with said window in order to guide it during its movement;
- and a fourth stage of fitting said internal element, when provided with said plurality of devices, to said external element mounted on said body by connecting said elements together using connection means.
- 70 According to a preferred embodiment of the present invention, the aforesaid internal element at least partly defines the inner lower surface of the door. Alternatively, the aforesaid method comprises a further stage subsequent or previous
- 75 to said fitting stage in which said internal element is joined to the frame, and consisting of joining to said frame an inner covering panel superposed on said internal element and at least partly defining the inner lower surface of said door.
- 80 The present invention also provides a motor vehicle door comprising a rigid frame defining an upper aperture arranged to be closed by a mobile window, and an inner lower aperture giving access to a chamber which is closed on the outside by a wall of said frame; characterised by comprising a
- 85 closure panel for said lower aperture which supports a plurality of devices comprising at least a window regulator device provided with a relative said mobile window, and at least one guide
- 90 channel arranged to cooperate with said window in order to guide it during its movement; said closure panel being demountably joined to said frame.
- According to a different embodiment of the present invention, there is also provided a motor vehicle door of the type comprising an external element arranged to be mounted on the assembly line on a vehicle body, and an internal element arranged to be mounted outside the assembly line,
- 100 characterised in that said internal element is formed from a cross-member on which a series of parts are mounted.
- According to a further embodiment, the present invention also relates to a motor vehicle door,
- 105 characterised by being composed of an external element defining an aperture arranged to be closed by a mobile window and arranged to be hinge-mounted on to a body on an assembly line, in the correct position relative to an internal
- 110 element which is preassembled outside the assembly line and comprises a frame-shaped portion internally defining said aperture, and a framework integral with the frame-shaped portion and provided with a plurality of cross-members on
- 115 which are fixed a plurality of devices and an internal covering panel for said door.
- Non-limitative embodiments of the present invention will be described below with reference to the accompanying drawings in which:
- 120 Figure 1 is a side elevation, taken from the interior, of a door constructed by the method of the present invention;
- Figure 2 is an exploded view of a first embodiment of the door of Figure 1, with parts removed for clarity;
- 125 Figure 3 is an exploded view of a second embodiment of the door of Figure 1, with parts removed for clarity;
- Figure 4 is a section on the line IV—IV of



Figure 1;

Figure 5 is an exploded side view of a further embodiment of the door according to the invention, with some elements removed for simplicity;

Figure 6 is a side view of an element of the door of Figure 5; and

Figure 7 is an exploded view of a door constructed in accordance with a further embodiment of the present invention.

Figure 1 shows a door indicated overall by 1, which as illustrated in Figures 2 and 3 comprises an outer rigid frame indicated overall by 2.

In the examples illustrated in Figures 1—4, the frame 2 is constituted by an outer plate 3 comprising an upper frame-shaped portion 4 (Figure 4) and a lower solid wall 5, and an inner plate 6 rigidly connected to the plate 3. The plate 6 is in the form of a frame-shaped member defining lowerly, in a position corresponding with the wall 5, a lower inner aperture 7 giving access to an inner chamber 8 closed externally by the wall 5, and defining upperly an aperture 9 surrounded externally by the frame-shaped portion 4 and arranged to be closed by a mobile window 10.

In the embodiment shown in Figure 2, the mobile window 10 is supported by a panel 11 preferably of plastics construction and mounted on the frame 2 in such a manner as to close the aperture 7.

The panel 11 is preferably constructed by moulding, and on that surface facing the interior of the motor vehicle is in one piece with a projection defining and arm support element 12. Through the panel 11 there is provided an aperture 13 through which a handle 14 is mounted, supported by a bracket 15 embedded in the material of the panel 11 and arranged to allow a lock 17 to be opened by a control rod 16, the lock being supported by a bracket 18 which is also partly embedded into the material of the panel 11.

The lock 17 is provided in known manner with a rear locking lever 19 connected to a substantially vertical rod 20, the lower end of which is connected to the exit rod of a centrally controlled electromechanical door locking device 21 (which in some versions can also be dispensed with), connected to a support bracket 22 partly embedded in the material of the panel 11. The upper end of the rod 20 is connected to an operating pushbutton 23 mounted through an upper rib 24 for supporting a substantially horizontal seal lip 25 disposed facing a corresponding lip 26 carried by the frame 2, in order to define a slot (not shown) which communicates with a chamber 8 and is slidably engaged in a substantially fluid-tight manner by the window 10.

According to a non-illustrated modification, the lip 25 is carried by the frame 2, and the rib 24 constitutes a profile for connecting the panel 11 to the frame 2. Obviously in this case the devices 17 and 23 and, possibly, the device 21 would preferably be mounted directly on the frame 2.

The window 10 is supported in the chamber 8 by a lower bracket 27 rigidly connected to the slide 28 of a window regulator device indicated overall by 29. The slide 28 is slidably mounted along a guide 30 constituted by an arm of a U-bent tubular sheath 31, the other arm 32 of which extends upwards parallel to the guide 30 and is fixed to the panel 11 by two brackets 33 partly embedded in the material of the panel 11. This latter has fixed to it two further brackets 34 for connection to the guide 30, which comprises a longitudinal slot 35 slidably engaged by an arm (not shown) which connects the slide 28 to one end of a precompressed spring 36 slidably mounted along the sheath 31 and coupled by a screw-nut screw coupling (not shown) to the tubular shaft 37 of an electric motor 38 disposed between the guide 30 and the arm 32, and fixed to the panel 11 by a bracket 39 provided with end supports partly embedded in the material of the panel 11.

The window regulator device 29 can obviously be replaced by any other type of electrically or manually operated window regulator.

The lower edge of the window 10 is guided inside the chamber 8 by a channel 40 parallel to the guide 30 and fixed to the panel 11 by two partly embedded brackets 41.

In a non-illustrated embodiment, the rear edge of the window 10 is also guided by a channel similar to the channel 40 fixed to the panel 11. In contrast, as shown in Figure 2, the rear edge of the window 10 has no guide at its lower part, and is guided only in proximity to its upper end by means of a block 42 preferably of plastics construction. As shown in detail in Figure 4, the block 42 is of substantially T cross-section, and comprises a hollow shank 43 engaged by the periphery of the window 10, and a widened head 44. This latter slidably engages a cavity 45 defined by a section 46 gripped between the frame-shaped portion 4 and the top of the plate 6, and extending completely around the aperture 9. The cavity 45 communicates at its ends with a chamber 8, and in cross-section is in the form of a T closed in the direction of the aperture 9 by two opening lips 47 supported by the section 46.

In using the method, the frame 2 originating from the moulding lines is fed to the assembly line independently of and previously to the panel 11, where it is mounted on the hinges of the vehicle body and together with this latter is painted in special baths by known methods. After this, all the aforesaid components such as the lock 17, locking device 21, pushbutton 23, guide channel 10 and window regulator device 29 with its window 10 are mounted on the panel 11 at the work bench, are adjusted and tested. The panel 11 is then fed to the assembly line as a single piece, and is mounted on the relative frame 2 by means of a single assembly operation, normally consisting of fixing a few screws or similar connecting devices, following which a finished door is obtained, but without the external key-operated member (not shown) for controlling the lock 17.

From the foregoing, it can be seen that the presence of the panel 11 enables a considerable number of operations previously carried out along the assembly line to be transferred to the work bench, with considerable advantages in terms of accuracy and in particular assembly time.

In the embodiment shown in Figure 3, the panel 11 is replaced by a preferably metal panel 48 provided with apertures 49 to reduce the weight and to allow easy access to the chamber 8. In contrast to the panel 11, the panel 48 requires the use of an inner covering panel 50 comprising an aperture 51 allowing access to the handle 14, and preferably provided, on that surface (not shown) facing the interior of the motor vehicle, with an arm support projection similar to the element 12. In the illustrated example, all the components 17, 21, 29, 10 and 40 are carried preassembled on the panel 48. However, a proportion of these components, in particular the components 17, 21 and 23 used for fastening the door 1, could be mounted directly on the frame 2 after joining the panel 48 to this latter.

In the embodiment shown in Figure 5, the reference numeral 104 indicates the inner frame of a vehicle door, comprising a lower framework provided with cross-members 105 and, at its top, a frame-shaped portion 106, on the inner edge of which there is provided a seat 107 designed to contain a seal gasket, not shown in the figure, which is arranged to house the edges of a window 108.

A window regulator unit or device, indicated in Figure 5 by 110, is provided with a control gear 111, a flexible cable 112, a window support 114, and at least one guide channel, not shown in the figure. The guide channel can conveniently consist of the lower ends of the sides of the frame-shaped portion 106, these ends being of U cross-section.

A lock indicated by 116 is provided, and a set of transmission members partly shown in the figure and indicated by 118 connect said lock to a lever 120 forming part of a covering or finishing panel 122 shown in Figure 5.

Said panel is also provided with an arm support 123 and a handle 124 designed to engage with a stem 126 extending from the control gear 111 of the window regulator unit.

Figure 6 shows an external covering or element 128 of the vehicle door for fitting on to the element 104, and provided with a series of ribs 130 constituting its lower framework, and an upper frame-shaped portion 132 which defines the window aperture of said door and is designed to engage with the relative frame-shaped portion 106 of the internal frame or element of Figure 5 to define the seat for the edges of the window 108 when in its closed position.

The method for assembling the door formed from the elements of Figures 5 and 6 is described hereinafter.

The frame-shaped portion 106 and lower framework of the internal frame, both originating from the moulding stations, are joined together, for example by welding and riveting, in order to

form an integral element in a single piece capable of defining an internal frame for the door, this being carried out in a specific area outside the assembly line where all the aforesaid parts are already present in suitable containers.

A seal gasket, inside which the edges of the window 108 are slidably housed, is inserted in the seat 107 of the frame-shaped portion 106.

After this, the window regulator unit 110 is mounted on the lower framework of the internal frame, and before fixing it by known means to one of the cross-members 105, the lower edge of the window is rested in the window support 114, any transverse and horizontal slack which can occur between the window and seat 107 and between this latter and the support 114 are corrected, and said window is then fixed to said support.

The lock 116 together with the transmission members 118 are then mounted on the internal frame.

Before inserting the finishing panel and fixing it against the lower framework of the internal frame, the lever 20 is connected to the transmission members 118 and the handle 124 is connected to the stem 126 of the control gear 111, with the result that said lever becomes connected to the lock and enables this latter to be unlocked, and said handle becomes connected to the window regulator unit and enables this latter to control the vertical movement of the window 108.

At this point the internal frame 104, provided with all the parts, is fed to the assembly station to be fitted to the external covering 128 already mounted on the vehicle body and originating from the painting bath.

In this manner, a door is constructed in which the aforesaid parts are fitted in a single station, thus dispensing with those fitting areas on the assembly line scheduled for said operations.

In addition, the operator or operators responsible for this part of the assembly have a greater working area available, and can thus carry out these operations in a comfortable manner with a reduction in working times and a consequent saving in production costs.

Finally, in the embodiment shown in Figure 7, the reference numeral 203 indicates an external covering or element of a motor vehicle door provided respectively with a framework 204 terminating at its top in a frame-shaped portion 205 defining the window aperture of said door, and a compartment 206 designed to house a deflector.

A cross-member 207, acting as an internal frame for the door according to the invention and arranged for fixing to the framework 204, comprises a projection 208, two bridge portions 209, of which only one is visible in the figure, and two lugs 210, the front wall of the cross-member 207 comprising a series of through bores 211 and two passages 212 respectively.

In the two lugs 210 there are provided two slots 214 which house in a mobile manner two pins 216 having their heads in contact with said lugs, and their stems inserted in a fixed manner

into two through bores not shown in the figure and provided in two brackets 218 fixed against two guide columns or channels 220.

5 A seal gasket, not shown in the figure and designed to house the edges of the window 226, is inserted into the seats 224 of said guide columns 220.

10 A window regulator unit or device, indicated overall by 228, is provided with a flexible cable 230, a control gear 232 and a window support 234 to be joined in a secure manner, by known means such as resilient pins, to the window 226.

15 A lock indicated by 236 is provided with a series of transmission members 238, partly shown on the figure, which connect said lock to a lever 240.

20 An internal covering or finishing panel 242 is provided with an object carrying tray 244, a car radio loudspeaker 246 and a glass scraping gasket 248 disposed on the upper edge of said panel, this latter defining the inner surface of the door.

25 An arm rest 250 and a handle 252 are designed for mounting on the finishing panel 242, the former by fixing it against the cross-member 207 and the latter by coupling it to a stem 253 provided at that end of the window-regulator control gear which emerges from the cross-member 207.

30 The assembly of the door composed of the aforesaid elements shown in Figure 7 is described hereinafter.

35 The cross-member originating from the moulding station, and which already comprises the bores 211, the passages 212, the lugs 210 and the slots 214, the bridge portion 209 and the projection 208, reaches a specific area outside the assembly line where all the aforesaid parts are already present in suitable containers.

40 The window regulator unit, already preassembled and thus already comprising the flexible cable 230, the control gear 232 and the window support 234, is fixed to the cross-member 207 by locking it on to the bridge portions 209 using nuts and bolts.

45 The guide columns 220 provided with the brackets 218 are connected to the cross-member 207 by resting the upper facial walls of the brackets against the respective lower facial walls of the slots 210 such that the slots 214 of these latter correspond axially with the bores in said brackets.

50 After this, the pins 216 are inserted into said slots so that they can move transversely therein, and are then inserted in a fixed manner into the bores of the brackets 218.

55 By this means, the two guide columns 220 together with the brackets connected to them can move transversely, and with them the window 226 which, in a stage subsequent to that stated, is disposed together with a seal gasket in the seats 224 of the guide columns 220.

60 After this, the window 226 is fitted on to the window regulator unit and the window support 228 of this latter is fixed to said window by inserting known resilient pins between these two

components.

The transmission members 238 connected to the lock 236 are then mounted on the cross-member, and the lock is fixed on to the projection 208 of said cross-member.

70 After this, the finishing panel 242 is fixed against the cross-member 207.

75 The lever 240 with the transmission members 238 is then fitted into one of the passages 212 and simultaneously fixed against the finishing panel, and the handle 252 is connected to the stem 253 of the control gear, also fixing it simultaneously against said panel.

80 In this manner the lever 240, being connected by the transmission members 238 to the lock 236, is able to unlock this latter, and the handle 252, being connected by the stem 253 to the window regulator unit, is able to control the vertical movement of the window 226.

85 The arm support is then mounted on the finishing panel 242 and is fixed to the cross-members 207 by nuts and bolts.

90 At this point an internal frame element has been obtained, provided with all the door parts and devices, and is fed to the assembly stations for fitting to the external covering 203 which is already mounted on the vehicle body hinges and originates from the painting bath.

95 The window 226, already mounted on the internal framework, is inserted and adjusted in the seat of the frame-shaped portion 206 of the external covering by moving the guide columns 220 transversely, this being possible by the effect of the transverse movement which the pins 216 fixed to the brackets 218 can make in the slots 214 of the lugs 210.

100 In this manner, said window can make a similar transverse movement to enable its upper edge to be easily inserted into the seat of said frame-shaped portion, and to lie correctly inside said seat.

105 By virtue of the particular configuration of the described door, it is possible to provide a method for mounting the aforesaid parts on this latter in a single assembly station, thus dispensing with those assembly line areas scheduled for said operations using parts of cheaper construction than those of Figures 5 and 6.

110 The aforesaid sequence of operations for carrying out the assembly method according to the invention can be varied according to particular technical and practical requirements, within the scope of the inventive idea.

#### CLAIMS

120 1. Method of constructing a vehicle door comprising, in any logical order, the following steps:

125 constructing an external element of said door comprising a rigid frame defining an upper aperture to be closed by a movable window and at least one lower cavity closed towards the outside of said vehicle by a wall formed integrally with said frame;

mounting said external element on the hinges

of the body of said vehicle and painting it together with said body;

constructing an internal element of said door, arranged to close said cavity towards the inside of said vehicle, and mounting on said internal element a plurality of parts of said door which parts comprise at least a window regulator device, said movable window connected to said window regulator device, and at least one guide channel arranged to cooperate with said window in order to guide it during its movement;

and fitting said internal element when provided with said plurality of parts, to said external element which is already mounted on said body by connecting said elements together.

2. Method as claimed in claim 1, wherein said plurality of devices also comprises locking means for said door.

3. Method as claimed in claim 1 or claim 2, wherein said internal element at least partly defines the inner lower surface of the door, said internal element consisting of a self-supporting closure panel for said cavity.

4. Method as claimed in claim 3, wherein said closure panel is of plastics and comprises on its surface facing towards the inside of the vehicle a projection constituting an arm rest.

5. Method as claimed in claim 1 or claim 2, comprising a further step subsequent to said step in which said internal element is fitted to said frame, and consisting of joining to said frame an inner covering panel superposed on said internal element and at least partly defining the inner lower surface of said door.

6. Method as claimed in claim 4 wherein said covering panel is of plastics construction, and comprises on its inwardly facing surface a projection constituting an arm rest.

7. Method as claimed in any one of claims 1 to 6 wherein said internal element is of metal construction.

8. Method as claimed in claim 1 or 2 wherein said internal element comprises a cross-member arranged for fixing to said external element and carrying said plurality of parts and a covering panel arranged to define the inner lower surface of said door and fixed to said cross-member prior to said step of fitting the internal element to the external element.

9. Method as claimed in claim 8, wherein said step of constructing said internal element comprises the following operations:

A) mounting said window regulator device on said cross-member by fixing it on bridge portions provided on the cross-member;

B) mounting two said guide channels on said cross-member, with upper facing walls of brackets of the guide channels nesting against the respective lower facing walls of respective lugs of said cross-member such that respective bores in the former correspond axially with respective slots in the latter, then inserting respective pins slidably into said slots and inserting said pins fixedly into the bores of said brackets;

C) inserting a seal gasket into respective seats

of the guide channels, inserting the edges of said window into said gasket, and fixing the gasket onto a support of the window regulator device;

D) fixing a lock and related transmission members on to said cross-member;

E) fixing said covering panel against said cross-member, mounting a lever and a handle on to said panel by connecting the lever to the transmission members of said lock and the handle to the stem of a control gear of the window regulator device;

F) mounting an arm rest on the covering panel by fixing said arm rest against the cross-member.

10. Method as claimed in claim 1 or claim 2, wherein said internal element comprises a framework provided with a plurality of cross-members arranged for fixing to said external element and carrying said plurality of parts, and a frame-shaped portion arranged to engage said aperture defined by said external element and provided integrally in a single piece with said framework; a covering panel arranged to define the inner lower surface of said door being fixed to said framework prior to said step of fitting the internal element to the external element.

11. Method as claimed in claim 10, wherein said step of constructing the internal element comprises the following operations:

A) inserting a seal gasket into a guide in the frame-shaped portion of the internal element;

B) inserting the edges of the window into said seal gasket;

C) inserting the lower edge of the window into a support forming part of the window regulator device, adjusting the window in said guide and said support, and mounting and fixing said window regulator device on to one of the cross-members of the framework of the internal element;

D) mounting the lock and related transmission members on the framework.

12. Method as claimed in claim 11, further comprising connecting a lever to the transmission members of the lock and connecting a handle forming part of the covering panel to a stem of a control gear for the window regulator device, and mounting and fixing said panel against the framework of the internal element.

13. Motor vehicle door constructed by a method as claimed in any one of the preceding claims.

14. Motor vehicle door, comprising a rigid frame defining an upper aperture arranged to be closed by a movable window, and an inner lower aperture giving access to a chamber which is closed on the outside by a wall of said frame; and a closure panel for said lower aperture which supports a plurality of door parts comprising at least a window regulator device, said mobile window and at least one guide channel arranged to cooperate with said window in order to guide it during its movement; said closure panel being demountably joined to said frame.

15. Door as claimed in claim 14, wherein said plurality of door parts supported by said closure panel also comprises fastening and locking means

for said door.

16. Door as claimed in claim 14 or claim 15, comprising a covering panel joined to said frame and at least partly covering the inner surface of said closure panel.
17. Motor vehicle door of the type comprising an external element arranged for mounting on to a vehicle body on an assembly line, and an internal element arranged for assembly outside the assembly line, wherein said internal element is formed from a cross-member on which a series of parts are mounted.
18. Door as claimed in claim 17, wherein the parts mounted on the cross-member are, respectively, a window regulator device, a window, two guide channels for said window, a lock and related transmission members, and an internal covering panel for said door.
19. Door as claimed in claim 18, wherein said cross-member comprises a plurality of lugs, each of which comprises slots arranged to slidably contain means for connecting said cross-member to said guide channels.
20. Door as claimed in claim 18, wherein said cross-member comprises a plurality of bridge portions arranged to fix the window regulator device to said cross-member.
21. Door as claimed in claim 19 or claim 20, wherein into the seats of said guide channels there is inserted a seal gasket slidably housing the

edges of the window, which is fixed to a support forming part of the window regulator device.

22. Door particularly for motor vehicles, comprising an external element defining an aperture arranged for closure by a mobile window, and arranged for hinge-mounting on to a vehicle body on an assembly line, correctly positioned relative to an internal element preassembled outside the assembly line and comprising a frame-shaped portion internally defining said aperture, and a framework integral with the frame-shaped portion and provided with a plurality of cross-members on which a plurality of door parts and an internal covering panel for said door are fixed.
23. Door as claimed in claim 22, wherein a seal gasket in which the edges of said window are slidably inserted are also preassembled on the frame-shaped portion outside the assembly line.
24. Door as claimed in claim 22, wherein said door parts comprise a window regulator device and a lock and related transmission members.
25. A method of constructing a vehicle door substantially as any such method herein described with reference to the accompanying drawings.
26. A door substantially as any herein described with reference to the accompanying drawings.
27. A motor vehicle having at least one door according to any one of claims 13 to 24 and 26.

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